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NOT TO BE TAKEN FROM THE ROOM
POUR LA CONSULTATION SUR PLACE

Bats in the Limelight

Bats – the mere mention of their presence is enough to send many people into paroxysms of fear. Images flood the mind – of darkness and evil, of vampires and rabies, of wild erratic flight ending in a terrifying tangle of bats and hair. Myths about bats abound – we've grown up with Macbeth, Hallowe'en and Dracula, as well as stories that bats carry rabies, that all bats drink blood, that they deliberately fly into your hair, that they are blind.

The real lives of bats are quite different from these visions of our imagination, and some aspects of them are treated in a new NMNS travelling exhibit entitled *Nightwings*. Closer scrutiny shows that bats are highly specialized and interesting creatures, vastly different from the murky visions our mythology has created.

There are 950 different kinds of bats in the world. The smallest bat weighs less than a dime while the largest, a flying fox, weighs 2 kg and has a wingspan of up to 2 metres. Besides hanging upside-down and flying, some bats can swim, jump, walk, climb, swing, catch fish, and hover at open flowers sipping nectar with long hairy tongues.

Three kinds of bats drink blood. Named after the legendary human vampires who came back from the dead to feed on the blood of living people, vampire bats occur only in South and Central America and live on the blood of birds, wild animals and livestock. Contrary to their horror movie image, they are medium-sized bats (40 grams). Movie producers usually cast large flying foxes as vampires, but in *Papillon* a small (12 g) Mexican free-tailed bat played the vampire.

The majority (70%) of bat species eat insects, but some feed on fish, birds, frogs, fruit, the nectar and pollen of night-blooming flowers, and even on other bats! Each species has special adaptations suited to its own particular lifestyle, and a Who's Who of bat faces ranges from the dog-like to the truly grotesque.

Bats suckle their live-born young just as we do, yet they are the only mammals with the ability to fly. They forage at night, and most of them find their way in this aerial darkness by echolocation, a sophisticated biosonar system for which they are rightly famous.

There are billions of bats in the world. In number of species, they are the second-largest order of mammals, and they occur in most parts of the world except the Arctic and Antarctic. At dusk they invade the airspace, taking the place that birds so colourfully occupy during the day. Yet few people are even aware that they exist. Many who could name and talk about a dozen species of birds claim they have never even seen a bat. Unless bats are the undesired tenants of an attic, there seems little reason to think of them at all, except in connection with midnight movies and Hallowe'en.

The nocturnal habits of these elusive creatures have made them difficult to study, and comparatively little is known about them. While the mobility, variety, distribution and biology of birds has been well-studied and documented, we are quite in the dark about bats. Scientists are still describing new species of bats and our knowledge of Canadian bats is quite incomplete. Details about the evolution of bats also present an unsolved mystery; their thin, fragile bones do not make good fossils, and as a result their story may have disappeared into the dusts of the past.

Many of the unanswered questions about bats have important implications. Since the 1930s, echolocation has been the subject of much research, the results of which may be useful in the development of a new technology for the blind. When we understand how the brains of bats process information in the echoes of their sounds, we may acquire a better understanding of how our own brains work. The longevity of bats is another intriguing aspect of their biology. In 1980 some little brown bats originally banded in southwestern Ontario, were discovered to have survived at least 30 years! Amazing for an animal that weighs only 8 grams. Records of bats living over 20 years in the wild are common – is this a function of their ability to hibernate?

The lives of bats hold many secrets that will only be discovered by careful research. But it is in the appreciation of these small creatures that the biggest strides must be taken. The veil of ignorance that has kept bats a mere shadow in our minds has also kept many of us from understanding their place in the natural world and our responsibility towards them. This has led some bats to the brink of extinction.

While the relationship between the decline of bird populations and insecticides is well-known, few stop to think that these same poisons are also affecting bats. Bats are especially vulnerable to human disturbance and habitat destruction because of their habits of roosting in large numbers and in buildings. Each year thousands of bats are killed in vain attempts to evict them.

Recently bats have also developed a widespread and undeserved reputation as rabies-carriers, and this has combined with superstition to make people much more ready to kill bats than to look at them.

Nightwings provides a chance to get closer to bats. And as understanding and knowledge replace the fear our mythology has created, bats will finally take their rightful place in our minds as the unique animals they are.

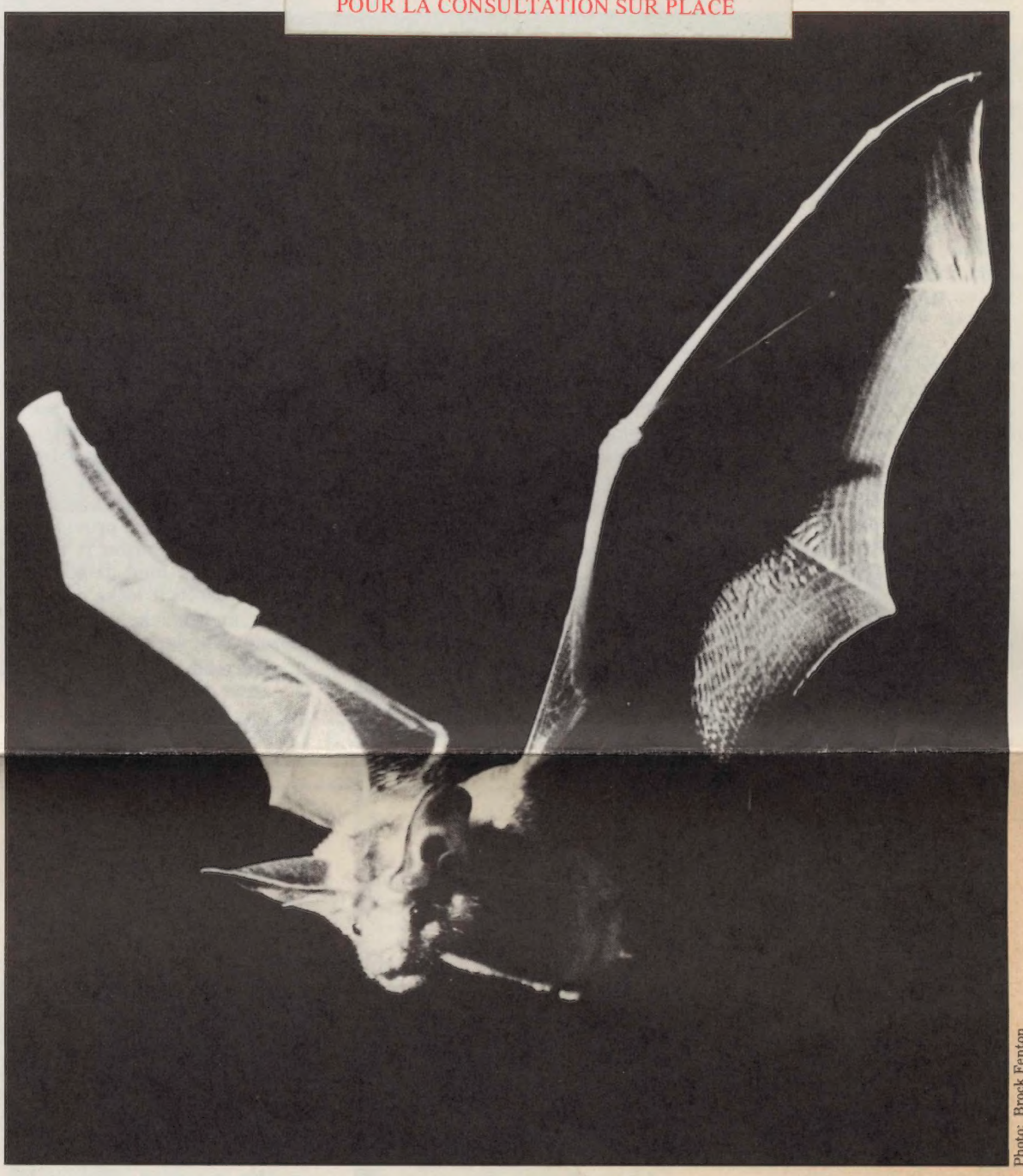

Photo: Brock Fenton

Photos: Brock Fenton

Bat faces have many adaptations according to their particular lifestyle. The bats above, from left to right, are: a dog-faced bat, a bent-winged bat, an African trident-nosed bat, a tube-nosed bat and a slit-faced bat. The bat in flight above is a pallid bat, one of 19 species of bats found in Canada.

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EDITORIAL

Like most people, whenever I find myself alone out in the country on a dark night, I can't help feeling a tiny prickling of uneasiness. Perhaps it's an ancestral fear of the dark, from the ages when Man hadn't yet domesticated the light and heat of fire, but the muffling of my sight seems to make my hearing, and my imagination, all the more acute. The things that might live in the world of darkness are perhaps better left unseen.

Or so I thought until I recently came across a book that showed, in beautiful colour, the strange forms and even stranger habits of the bats of the world. I never knew there were so many kinds of bats. There are even bats that pollinate night-blooming tropical flowers, flitting from blossom to blossom as they feed on the pollen and nectar within.

Since then, what were formerly shadowy creatures associated with Hallowe'en and Count Dracula are now elegant examples of Nature's amazing ingenuity and design. Some of them are even cute, in a baroque sort of way.

They are certainly necessary. Even conservative estimates show that astonishing numbers of insects are consumed by bats every summer night. As a person who seems to drive mosquitos into a feeding frenzy, I can appreciate bats' contribution to the ecosystem.

In this issue of BIOME we want to turn you into chiropterophiles. Although this sounds like the evil spell of a wicked sorcerer, I assure you that the change won't affect your outward appearance. It will however be permanent. Merely read this issue of BIOME and the deed will be done.

Deep within the recesses of the Museum, our exhibits team has been working fiendishly to bring to life a new travelling exhibit – "Nightwings". The chief writer of BIOME, Carol Thiessen, has helped in the planning and writing of this exhibit. If you are in Ottawa during the summer of 1982, drop in to the Museum and learn more about bats. After its stay in Ottawa, Nightwings will be travelling across the country. Watch for it!

Now that I have your attention, I'd like to put out a plea for feedback from you, the readers of BIOME. Do you like the tabloid format? Should we treat several themes per issue instead of one? What would you say to a page of news about the latest developments in the natural sciences? If you have any comments on BIOME, don't be shy. After all, you are the lifeblood, so to speak, of our paper.

E.M.

Bats in the News • Bats in the Ne

Sky Wars

We may not be aware of it when we gaze up at the night sky, but an aerial war is being fought around us that may well rival the Battle of Britain.

In an article published recently in *American Scientist,* biologists Brock Fenton of Carleton University and James Fullard of the University of Toronto reported that moths and their bat predators may be constantly developing and changing their defense and counter-defense tactics in order to gain short-lived advantages over each other in their struggle for survival.

The fact that bats use echoes to navigate and locate prey was first discovered by researchers in the 1930s. Much as radar is used in human warfare, insectivorous bats search and track their prey by sending out a series of high-frequency calls, the echoes of which provide the bat with information it needs. Once a bat has detected a specific insect, it locks onto the target and tracks it through subsequent evasive maneuvers, finally ending in an attack.

However, many species of moths have ears, "early warning systems" which enable them to detect the calls of an approaching bat long before the bat receives echoes from the moth. The moth's hearing organ is primitive, too primitive to distinguish between frequencies, but Fenton and Fullard have discovered that it is finely tuned to be sensitive only to those frequencies commonly emitted by bats in the area. Dr. Fullard has commented that this hearing apparatus is "less an ear than a bat detector", one which is actually *more* sensitive than the most sensitive bat-detecting microphones used by human researchers today.

Acute hearing gives the moths an advantage, for when they detect the echolocation calls of a distant bat they usually react by flying quickly in the opposite direction. Louder calls, which herald an imminent attack, cause the moth to go into a series of unpredictable flight maneuvers, usually culminating in a dive to the ground.

Yet another dimension is involved in this contest between bat and moth. Some tiger moths appear to jam the echolocation system of attacking bats by producing trains of ultrasonic clicks which are remarkably similar to the bat's echolocation calls. This may interfere with the information processing of the bat. When confronted with the clicks, little brown bats in the final stage of attack veer sharply away from their target.

Drs. Fenton and Fullard believe that the discovery of this complex acoustical war between bats and moths is a landmark in the study of animal behaviour. It provides evidence that animals do not evolve independently but respond to many forces in their environment.

They are now making progress in studying yet another twist to the story – the possibility that bats are developing counter-counter strategies to these insect defenses by varying their echolocation calls, or by using cues other than echolocation to locate and track their prey.

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Science Meets the Vampire

In ancient mythology, the blood-sucking vampire terrorized the countryside until someone arrived on the scene who knew how to kill it by driving a stake through its heart. Real-life vampire bats are not nearly as terrible as the legend after which they are named, but their thirst for the blood of animals has brought scientists up against an equally perplexing problem.

In the days before the Americas were discovered and settled by Europeans, vampire bats subsisted on the blood of wild animals and birds. Their numbers may have been kept in check by the problems involved in finding food. When domestic livestock was introduced to their range, it was like laying out a banquet table. As herds of domestic animals became more numerous, so did the populations of Common Vampires.

Today rabies spread by vampire bats poses a real and significant threat to livestock. Each year hundreds of thousands of domestic cattle from Mexico to Argentina die from infection and disease transmitted by vampire bats. For poor farmers trying to eke out a living these losses can be catastrophic.

As a result, scientists from the U.S. Agency for International Development have mounted a program to control the numbers of vampire bats. Faced with the problem of how to kill the bats that plague livestock without destroying other beneficial species, scientists have hit upon a solution as ingenious as driving a stake through the mythological vampire's heart.

Photo: Robert Herd

The razor-edged teeth of the Common Vampire are used to make a painless incision on the exposed skin of its prey. Livestock are usually more bothered by the bats walking on them than by the bites they inflict, and if it weren't for the possibility of rabies, vampire bats would cause no more trouble than a pesky insect.

In the dark of night they wait for the vampire bats beside corrals housing animals that have been attacked. Finely woven "mist nets" are strung up to entangle the marauding vampires, and they are then coated with a powerful anticoagulant that will cause a fatal hemorrhage in any bat that swallows it. When the guilty bats return to their roost and groom themselves and each other, the poison is spread from one bat to another. In this way, the scientists estimate that thirty bats will die for each one that has been caught and treated. But most importantly, only the vampire populations that feed on livestock are affected. Innocent vampires and other species remain unharmed!

Not all cultures are as prejudiced against the bat as ours is. In China the word for bat is *fu*, which is also the name of the written character for happiness. Thus the bat is a symbol of good things and is incorporated into many Chinese designs. Five bats are often used together, as in the drawing above, to signify the five blessings of health, wealth, virtue, longevity and a peaceful end.

Spotted Bat Spotted

Although we can't hear most of them, the echolocation calls of different species of bats are as varied and individual as the songs of birds. And that's just how a team of biologists from Carleton University and the National Museum of Natural Sciences discovered that a rare species of bat usually found in the southwestern United States is also a resident of Canada.

While studying the habits of various bat species in the Okanagan Valley, B.C., the scientists heard the echolocation calls of an unidentified bat over an open forest of ponderosa pines. Unlike the ultrasonic pulses of many bats, these calls were quite audible to the human ear, even at distances of 250 metres. The excited scientists were able to follow the bat through its searching and tracking maneuvers, and hear the feeding buzzes associated with the final attack on an insect.

The calls were quite unmistakeably those of the spotted bat (*Euderma maculatum*), a rare and beautiful species that is usually encountered in the arid highlands of California, Arizona and New Mexico. Since the biologists were unable to actually see the bat, they tentatively identified it as the spotted bat, and a year later confirmed it by collecting a specimen.

Photo: Brock Fenton

The Spotted Bat has the largest ears of any bat in North America, measuring nearly 5 cm in length. It is thought that their large surface area may play a role in helping the bat dissipate body heat in its desert habitat.

The specimen they took was a female and she was pregnant – an indication that this was not a stray or accidental individual, but part of a breeding colony. Numerous other sightings – or, more accurately, hearings – have confirmed the news. A colony of spotted bats is living and thriving well north of the 49th parallel.

Bat Fossils Found

Little is known about the ancestry of bats, but evidence indicates that they are more closely related to humans than to the mice they are often thought to resemble. Bats are believed to have evolved in arboreal habitats in tropical regions, neither of which is conducive to fossilization. As a result, complete fossil skeletons of bats are very rare. The earliest known fossil bat was found in Wyoming and is about 50,000,000 years old. This well-preserved specimen closely resembles the bats that exist today, and thus gives no real clue as to the evolution of flight in bats. But by studying the anatomy and teeth of this and other bat fossils found near Darmstadt, Germany, paleontologists have hypothesized that bats come from a group of tree-dwelling insectivores, and may have some relationship with the early origins of man. The picture below is a German stamp designed to celebrate the discovery of an exceptionally intact bat fossil in Germany.

Just singing in the rain...

For years biologists have been puzzled by the fact that some male frogs, when calling for a mate, are reluctant to use the very calls that are most attractive to females. Recent studies of a carnivorous bat have shed some light on this conundrum, and have revealed at the same time that bats may have as much impact on the behaviour of male frogs as do female frogs themselves.

In an article published recently in National Geographic (January 1982), Merlin D. Tuttle of the Milwaukee Public Museum reports that the frog-eating bat of Central and South America has unusually sensitive hearing at the same frequencies as frog mating calls. Thus, a bat out hunting for food can hear the songs of its frog prey from far away, and can even distinguish a frog's size and whether it is edible or poisonous.

This presents a bit of a problem for the amorous frogs – how to call for a mate without attracting a bat. Tropical frogs have come up with a number of tactics for survival – chirping near loud waterfalls, singing from the protective cover of thorn bushes, serenading on moonlit nights when bats are visible, and using simple, infrequent calls rather than the long, complex trills preferred by potential mates.

Photo: Brock Fenton

What is it???

Hibernating bats often cluster together in groups of several thousand, hanging from ceilings of caves and abandoned mine shafts. During the winter their breathing and heartbeat slow down considerably and their body temperature drops from about 36°C to just a few degrees above freezing. Their weight decreases steadily as stored energy is metabolized. Occasionally they may rouse enough to change position but if they are disturbed excessively during this period, the activity uses too much of their fat reserves, and they may die from starvation. Thus, people who visit caves in winter may inadvertently contribute to the deaths of thousands of bats. To protect dwindling bat populations, some conservation authorities have built gates across the openings of favourite hibernation sites.

Bats in your Belfry

Do you have bats in your belfry? If so, it would be wise to think twice before calling your local pest control company.

Researchers at Carleton University have reported that the use of pesticides and rodent repellers to discourage bats in the attic is actually ineffective and a needless contamination of the environment. They have concluded that the most effective and permanent way of controlling bat populations in buildings is also the most humane – sealing off the entrances used by the bats after they have vacated the nursery colonies in August.

In a series of experiments reported in various scientific journals they compared the use of several pesticides, including DDT, with other less contaminating control methods such as the application at entrance holes of sticky deterrents named Tacky Toes and Tanglefoot, and the use of ultrasonic rodent repellers. The ultrasonic repellers had no effect on the bats – some roosted right on the machine – and the sticky substances simply caused the bats to move to other entrances or avoid treated surfaces, but not to vacate the roost.

While pesticides were somewhat more effective, they did not completely eliminate problem tenants and when the toxicity had decreased, the bats were quick to return, sometimes in greater numbers than before. In addition, the studies indicated that using the pesticides actually increased the possibility of contact between affected bats and the human occupants of the buildings, thus aggravating the very problem that the users were trying to avoid.

The only permanent method the researchers found to get rid of bats in buildings was to seal their access holes – by nailing down loose shingles, improperly sealed metal roofing and chimney flashing; by applying caulking compound to cracks between walls; and by filling cracks in chimneys with mortar.

This method may take more than one attempt, since bats are notoriously adept at finding tiny holes they had previously overlooked. But once finished, the success is permanent – and the next time you overhear the neighbors talking about bats in your belfry, you can rest assured they're not talking about your attic.

Photo: Brock Fenton

In this house there is enough space between the wood and stone to make an ideal roosting spot for bats. Evidence that they have set up housekeeping is indicated by the stains on the stonework.

A Bat in the Hand

If you do have a bat in your belfry – or spot one flying overhead in the evening – how can you tell what kind of bat you're looking at?

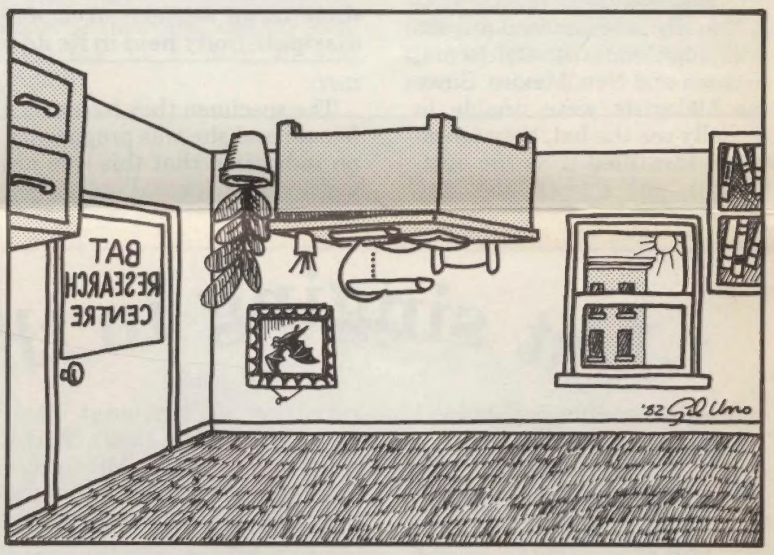
Bat researchers tell us that the identification of bats is not easy. Unlike whales which can be identified at a distance by their silhouettes and by the shape of their blow, or birds which have recognizeable songs, colours and flight, Canadian bats appear so similar from a distance that it is difficult for the average person to distinguish one species from another.

But experts in the field do offer a few guidelines for interested bat watchers. Of the 19 species of bats recorded in Canada, 2 are probably accidental sightings and 13 are found in the dry valleys of south-central British Columbia.

By far the most common species are the little brown bat and the big brown bat. They range throughout the country, and are often seen at dusk catching moths around street-lamps or flitting over ponds and lakes. These species are well-adapted to urban life and are the bats most likely to come in contact with humans; they are often found in attics, behind shutters and under the eaves of houses. Little brown bats and big brown bats are similar in appearance, but can be distinguished by their size. Hoary bats, red bats and silver-haired bats are also quite common across southern Canada, but are observed less frequently because they are solitary forest-dwelling creatures, and prefer to hunt in complete darkness.

Our researchers are quick to point out, however, that the challenge of bat watching for the average person is not so much in distinguishing one species from another but in being aware of them at all.

The work of comparing subtle characteristics of related species is a matter for the taxonomist. Staff at the National Museum of Natural Sciences have been studying the distribution and taxonomy of Canadian bats and have made significant contributions to this field. Dr. C.G. van Zyll de Jong, Curator of Mammals, and his assistant, Donna Naughton, sent us this report from the Curator's desk . . . .



In recent years, the Mammalogy Section has been placing increasing emphasis on studies of Canadian bats, particularly in the systematics, distribution, and abundance of these unusual and elusive mammals. Information on these aspects of bats in Canada has been scarce in the past, due primarily to the difficulties of detecting and capturing the bats. The only known collecting technique was to use shotgun and dust shot. A mammalogist had to have a bat in hand in order to identify it, and that meant shooting it. But since bats are nocturnal, or at best crepuscular, the collector was literally shooting in the dark. Needless to say, this was often a time-consuming and fruitless pursuit.

Within the last two decades, bat capture techniques have improved greatly. Japanese mist nets, used for centuries to catch live birds, were discovered to be equally effective for bats, and in 1974, the Tuttle bat trap was introduced. No longer did the researcher need to shoot and kill every specimen. A properly set Tuttle trap can catch scores of bats in a single night, and they can be examined, banded, measured, identified, and released with little or no harm.

The bat detector, a very recent and exciting piece of field equipment, is a major advance in the study of bat ecology and distribution. It is an electronic device which detects the bat's ultrasonic sounds and transforms them to audible sound or to a visual representation on an oscilloscope. Since every species has a distinctive vocalization, the bat detector has made it possible to identify bats on the wing.

These techniques were put to good use on a very successful field trip in 1979. Museum scientists and researchers from Carleton University collaborated in a study of the bat fauna of the Okanagan Valley in British Columbia. This region supports one of the most diverse and numerous bat communities in Canada. During the expedition, researchers re-discovered the pallid bat *(Antrozous pallidus)* and the fringed bat *(Myotis thysanodes)*, which had not been seen in the area since the first records were established in the 1930s. Members of the expedition also heard, but were unable to capture, the rare spotted bat *(Euderma maculatum)*, a species not previously recorded in Canada. Over 400 bats were captured during the 1979 field season, and most were examined and released. A representative sample was kept for the Museum's collection to be used in further research. These, of course, did not include any rare or protected specimens.

Since only 19 species of bats have been recorded in Canada, there are few major systematic problems. However, in some regions, where the ranges of similar species overlap, there can be great difficulties in identification. The species complex of long-eared *Myotis* is a case in point. Three species, all closely related and very similar in appearance have converging ranges in parts of western Canada. The Curator of Mammals, Dr. C.G. van Zyll de Jong, has been able to show, after painstaking multivariate analysis on a computer, that *Myotis evotis, Myotis keenii* and *Myotis septentrionalis* exhibit recognizable differences and that *Myotis septentrionalis* is a species in its own right and not a subspecies of *Myotis keenii* as was previously supposed. Similar techniques have been used to study and distinguish other species such as *Myotis leibii – Myotis californicus* and *Myotis lucifugus – M. yumanensis.*

At present *Mammals of Canada* is the only guide to Canadian bats, but information is now being compiled for use in a book on the bats of Canada. This volume will be published in the near future and will reflect the current state of knowledge about our bat fauna.

Canada is a large country and many areas are poorly surveyed. With more efficient bat traps and new electronic "bat detectors", we most certainly will increase our knowledge of the distribution of our bat species. Perhaps we will even turn up another new species.

Bats take the Rap

Many people assume that bats are dangerous because they have rabies. Although this can be a problem among the blood-eating bats of Central and South America, in Canada fewer than 1% of rabies cases are attributable to bats. Despite their reputation, bats are less likely to cause rabies than foxes, cows, skunks or dogs. Researchers who have worked with bats say they are very gentle creatures. Even if rabid, they are seldom aggressive and usually only bite in self-defense.

Bats normally avoid people. If you find a bat that appears tame, it may be sick and should be left alone. If you must pick up a bat to remove it, gloves should be worn as a precaution.